CHAPTER 03500 INSTALLATION OF STORMWATER FACILITIES

SECTION 03501 GENERAL

03501.01 Pipe Cover, Grade, and Separation from Sanitary Sewers

Pipe

Pipe grade shall be such that, in general, a minimum of 2.0 feet of cover is maintained over the top of the pipe. If the pipe is to be placed under pavement, then the minimum pipe cover shall be 2.5 feet from top of pavement to top of pipe. Uniform slopes shall be maintained between inlets, manholes and inlets to manholes. Final grade shall be set with full consideration of the capacity required, sedimentation problems, and other design parameters. Minimum and maximum allowable slopes shall be those capable of producing velocities of between 2.5 and 10 feet per second, respectively, when the sewer is flowing full. Maximum permissible velocities for various storm sewer materials are listed in Table 03501-1. A minimum of 18 inches of vertical separation between storm sewers, water and sanitary sewers shall be required. When this is not possible, the sanitary sewer must be encased in concrete or ductile iron within 5 feet, each side, of the crossing centerline and in relation to the waterline, water class pipe must be used for the storm and sanitary sewers. Minimum horizontal separation between storm sewers, water and sanitary sewers shall be 10.0 feet and 8.0 feet to the structures. All other utilities shall maintain a minimum separation of 3.0 feet from storm structures.

Rear Yard Swale

Rear yard swales shall have a minimum slope of 2% gradient. Swales less than a 2% gradient are required to have double wall, smooth bore perforated drain tile installed two (2) feet below the invert of the swale. Minimum swale slope shall be greater than 1% gradient. Subsurface drains shall have a minimum slope of 0.5% gradient.

Proposed road grades will be required to be graded within two (2) inches of the proposed sub-grade prior to installation of SSD. Trench width for SSD shall be a minimum of three (3) inches on both sides of the SSD, with a minimum trench width of twelve (12) inches.

03501.02 Alignment

Storm sewers shall be straight between manholes and/or inlets.

03501.03 Manholes/Inlets

All manholes and inlets must be pre-stamped with an appropriate message per the City of Westfield Public Works Department Standards and Specifications. Manholes and/or inlets shall be installed to provide human access to continuous underground storm sewers for the purpose of inspection and maintenance. The casting access minimum inside diameter shall be no less than 22 inches or a rectangular opening of no less than 22 inches by 22 inches. Manholes shall be provided at the following locations:

1. Where two or more storm sewers converge.
2. Where pipe size or the pipe material changes.
3. Where a change in horizontal alignment occurs.
4. Where a change in pipe slope occurs.

5. At intervals in straight sections of sewer, not to exceed the maximum allowed. The maximum distance between storm sewer manholes shall be as shown in Table 03501-2.

In addition to the above requirements, a minimum drop of 0.1 foot through manholes and inlet structures should be provided. Pipe slope should not be so steep that inlets surcharge (i.e. hydraulic grade line should remain below rim elevation).

Manhole/inlet inside sizing shall be according to the City of Westfield Public Works Department Standards and Specifications. Note that the WPWD may require the applicant to provide pre-treatment BMPs prior to discharge of the storm sewer line into a pond.

03501.04 Installation and Workmanship

Bedding and backfill materials around storm sewer pipes, subsurface drains, and the associated structures shall be according to the City of Westfield Public Works Department Standards and Specifications. The specifications for the construction of storm sewers and subsurface drains, including backfill requirements, shall not be less stringent than those set forth in the latest edition of the INDOT Standard Specifications. Additionally, ductile iron pipe shall be laid in accordance with American Water Works Association (AWWA) C-600 and clay pipe shall be laid in accordance with either American Society of Testing Materials (ASTM) C-12 or the appropriate American Association of State Highway and Transportation Officials (AASHTO) specifications. Dips/sags on newly installed storm systems will not be allowed. Also, infiltration from cracks, missing pieces, and joints shall not be allowed. Variations from these standards must be justified and receive approval from the WPWD. Notification must be made to WPWD inspectors at least 48 hours prior to installation. All structures shall require inspection prior to backfill.

03501.05 Special Hydraulic Structures

Special hydraulic structures required to control the flow of water in storm runoff drainage systems include junction chambers, drop manholes, stilling basins, and other special structures. The use of these structures shall be limited to those locations justified by prudent planning and by careful and thorough hydraulic engineering analysis. Certification of special structures by a certified Structural Engineer may also be required.

The use of stormwater lift stations will not be permitted under any circumstances.

03501.06 Connections to Storm Sewer System

Unless otherwise approved, perforated subsurface drain tiles, footer drains, or sump pumps lines shall connect to a storm structure. Storm sewer connections shall be provided by either precast or core drilled holes, which are to be a minimum of two (2) inches larger than the O.D. of the connecting tile. Drain tile connections shall be made with either "Tee" or "Wye" method. If no storm infrastructure is available, these lines discharge lines shall be appropriately daylighted.

Blind connections to storm sewer pipes shall not be allowed.

Subsurface drain tile as specified herein may be used to convey water collected in sump pits and footer drains to an acceptable storm sewer outlet, provided these drain tiles are properly sized to accept these flows.

Gutter or building drains shall not be allowed to outlet directly into storm sewer systems.

To allow any connections to the storm sewer system, provisions for the connections shall be shown in the drainage calculations for the system. Specific language shall be provided in the protective covenants, on the record plat, or with the parcel deed of record, noting the ability or inability of the system to accommodate any permitted connections, for example, sump pumps and footing drains.

1. **Sump pumps** installed to receive and discharge groundwater or other stormwater shall be connected only into "D" subsurface drain (SSD) lateral connection. Sump pumps installed to receive and discharge floor drain flow or other sanitary sewage shall be connected to the sanitary sewers. A sump pump shall be used for one function only, either the discharge of stormwater or the discharge of sanitary sewage, each being connected to the respective receiving system only.

2. **Footing drains and perimeter drains** shall be connected only into "D" subsurface drain (SSD) lateral connection.

3. All **roof downspouts**, roof drains, or roof drainage piping shall discharge onto the ground and shall not be directly connected to the storm drainage system. Variation from this requirement may be requested and granted by the WPWD in special circumstances. No downspouts or roof drains shall be connected to the sanitary sewers.

4. **Garage and Basement floor drains and water softener discharge** shall not be connected to the storm sewers.

5. **Swimming Pool drains** shall not be connected to the storm sewers unless the water is dechlorinated prior to being connected to the storm sewer.

03501.07 Inspection and Rejection of Pipe

The quality of all materials, the process of manufacture, and the finished pipe shall be subject to inspection and approval by the WPWD. Such inspection may be made at the place of manufacture or on the construction site after delivery, or at both places; and the pipe shall be subject to rejection at any time on account of failure to meet any of the specifications' requirements even though sample pipes may have been accepted as satisfactory at the place of manufacture.

Prior to being lowered into the trench, each pipe shall be carefully inspected and those not meeting the specifications shall be rejected and at once removed from the work.

The WPWD shall have the right to cut cores from such pieces of the concrete pipe as the inspector desires for such inspection and tests as the inspector may wish to apply. The Developer/Contractor shall pay for the samples of an Independent Laboratory Testing.

Holes left by the removal of cores shall be filled in an approved manner by and at the expense of the manufacturer of the pipe.

The WPWD shall also have the right to take samples of concrete after it has been mixed, or as it is being placed in the forms or molds, and to make such inspection and tests thereof as the inspector may wish.

Any pipe which has been damaged after delivery will be rejected and replaced solely at the Contractor's expense.

After installation, any deficiencies in the pipe revealed during the televising review shall be repaired by the Contractor, as noted below:

1. RCP
    a. Remove damaged pipe section and continue removal of pipe sections to the nearest structure, or
    b. An interior pipe lining or patching method, as approved by WPWD.

2. SSD
    a. An approved flexible coupling with stainless steel clamps, or

b. An external snap coupling.
c. Split couplers or internal couplers shall not be permitted.

3. If a different pipe material is used, consult with WPWD for an approved method of repair.

03501.08 Handling Pipe

Each pipe section shall be handled into its position in the trench only in such manner and by such means as the WPWD approves as satisfactory. The Contractor will be required to furnish slings, straps, and other approved devices to permit satisfactory support of all parts of the pipe when it is lifted.

03501.09 Notice to WPWD

The WPWD shall be notified at least 48 hours prior to when the pipes are to be laid in the trench. At least 15 feet of the pipe shall, under ordinary circumstances, be laid before covering begins.

03501.10 Laying Pipe

All pipes shall be re-inspected for soundness and damage due to handling immediately before being lowered into the trench. Any pipe found to be unsound or damaged will be rejected and shall be removed immediately from the site of the work.

Except by permission of the WPWD not more than 100 feet of trench shall be opened at any one time. Not more than 30 feet of trench may be opened in advance of the completed pipe laying operation, and not more than one street crossing may be obstructed by the same trench at any one time.

No portion of a storm sewer pipe, open culvert, manhole, inlet, or subsurface drain tile system shall be installed directly or indirectly onto frozen ground or with frozen backfill materials.

Where ground water is encounter, the contractor shall make every effort necessary to secure a dry trench bottom prior to installation of the storm water system. The contractor shall be required to maintain the groundwater level below the base of the excavation. The City nor the Westfield Public Works Department, will not assume any liability for the actions of the Developer or Contractor in the performance of the required dewatering operation. If trench conditions outlined in this section cannot be achieved, the WPWD may terminate installation until such efforts can be achieved.

All pipes shall be laid accurately to the required line and grade as shown on the drawings, and in the manner prescribed by the pipe manufacturer and appropriate ASTM Specifications, to form a close, concentric joint with the adjoining pipe and to bring the invert of each section to the required grade. The supporting of pipe on block will not be permitted.

Pipe laying shall precede upgrade, beginning at the lower end of the sewer.

Practically, watertight work is required, and the Contractor shall construct the sewers with the type of joint specified.

Joints between precast structures shall be sealed with (1) An approved rubber gasket manufactured and installed in accordance with ASTM C 443, latest version, (2) A 1/2 inch diameter non-asphaltic mastic (Kent Seal or approved equal) conforming to AADHTO M-198 and Federal Specifications SS 521-A, or (3) mortar or butyl rubber sealed on the outside

Regardless of the method chosen above, mortar sealed on the inside and brushed smooth is required.

The annular space between the pipe and precast structure walls shall be filled inside and outside with Class "A" Concrete. No grout mixtures will be permitted. Collars shall be formed around the annular space between the pipe and precast structure and trowel and broom finished.

All pipes shall be laid to the line and grade as shown on the drawings. Variations from a uniform line and grade as shown on the drawings shall be cause for the line to be rejected.

The ends of the pipe shall be satisfactorily cleaned just before laying, and the joint shall be made in a satisfactory manner in accordance with the recommendations of the manufacturer on the particular type of joint. All joint work shall be done by experienced workmen.

All pipes shall be bedded as described in this specification under Pipe Bedding. Bell holes shall be excavated in advance of pipe laying so the entire pipe barrel will bear uniformly on the prepared subgrade.

Each length of pipe shall be mechanically pulled "home" with a winch or come-along against the section previously laid and held in place until the trench and bedding are prepared for the next pipe section. Care shall be taken in laying the pipe so not to damage the bell or the spigot end of the pipe. Mechanical means consisting of a cable placed inside the pipe with a winch, jack, or come-along shall be considered to pull the pipe home where pushing the pipe will not result in a joint going completely home and staying in place.

The Contractor shall use laser beam equipment, surveying instruments, or other proven techniques to maintain accurate alignment and grade.

Open excavation shall be satisfactorily protected at all times. At the end of each day's work, the open ends of all pipes shall be protected against the entrance of animals, children, earth, or debris by bulkheads or stoppers. The bulkheads or stoppers shall be perforated to allow passage of water into the installed pipe line to prevent flotation of the pipe line. Any earth or other material that may find entrance into the main sewer or into any lateral sewer through any such open end of unplugged branch must be removed at the Contractor's expense. The cost of all such plugs, and the labor connected therewith, must be included in the regular bid for the sewers.

Storm sewer which outlets into a Hamilton County Regulated Drain shall be approved, inspected, and constructed per the latest standards of the Hamilton County Surveyor's Office.

03501.11
Pipe Bedding
and Haunching

Each pipe section shall be laid in a firm foundation of bedding material and haunched and backfilled with care.

Prior to pipe installation, carefully bring bedding material to grade along the entire length of pipe to be installed. To provide adequate support for the pipe, the following bedding procedures shall be followed.

When angular 1/4 to 1/2 inch (6 to 12 mm) clean graded stone, slag, or crushed stone material is used for bedding, little or no compaction is necessary due to the nature of the angular particles. A depth of 4 to 6 inches is generally sufficient to provide uniform bedding. If Class I material is used for bedding, it must also be utilized for haunching up to or higher than the spring line of the pipe to avoid loss of side support through migration of Class II haunching material into the bedding.

1. Take care with coarse sands and gravels and maximum size 20 mm (3/4 inch) materials, to provide uniformly compacted bedding. Excavate the bedding material or place it to a point above the pipe bottom, determining such point by the depth of loose material resulting in the preparation of the bedding and the amount of compaction that will be

required to bring the material to grade. Use hand or mechanical tamping to compact the bedding material to a minimum 85% Standard Proctor Density.

2. Slightly damp material will generally result in maximum compaction with a minimum of effort. If water is added to improve compaction or if water exists in the trench, take care to avoid saturation of Class II material, which could result in additional stability problems. Check grade of bedding after compaction.

Bedding material shall have a minimum thickness beneath the pipe of 4 inches (100 mm) or one-eighth of the outside diameter of the pipe, whichever is greater, and shall extend up the sides of the pipe one-sixth of the outside diameter of the pipe.

The rigid pipe, such as concrete or ductile iron, backfill between the bedding material and a plane 12 inches (300 mm) over the top of the pipe shall be hand-placed finely divided earth, free from debris and stones, or granular backfill if required.

For flexible pipe, corrugated metal pipe, the placement of embedment material or haunching around the pipe must be done with care. The ability of the pipe to withstand loading in a trench depends a large part on the method employed in its installation. If crushed stone, pea gravel, or graded gravel or sand is used to backfill between the bedding material and a plane 12 inches (300 mm) over the top of the pipe, it shall be hand placed. If fine sand, silt, or clayey gravels are used for initial backfilling over the pipe, the material shall be hand placed in 6 to 8 inch layers and hand compacted on both sides of the pipe to an elevation 12 inches (300 mm) over the top of the pipe. Care should be taken so not to compact directly over the pipe.

In yielding subsoils, the trench bottom shall be undercut to the depth necessary and backfilled with graded, crushed stone to form a firm foundation.

Where excavation occurs in rock or hard shale, the trench bottom shall be undercut and a minimum of 6 inches (150 mm) crushed stone bedding placed prior to pipe installation.

03501.12 Concrete Cradle (Class “A” Bedding)

Concrete cradles shall be constructed of Class "A" concrete and of the design shown on the detailed drawings.

03501.13 Manholes and Other Structures

Manholes and other structures are to be constructed at locations shown on the drawings and in accordance with the following specifications:

Precast concrete manhole sections shall conform to ASTM Designation C478, except as modified herein:

1. The joint design of the precast sections shall consist of a bell or groove on one end of the unit of pipe and a spigot or tongue on the adjacent end of the joining section.

2. The joint shall consist of a flat rubber gasket attached to the spigot end of the precast manhole section and shall conform to Sections 6.1.6, 6.1.7 and 9 of ASTM Designation 443, latest revision.

Openings in manhole sections for sewer connections shall be cut at the point of manufacture and shall be circular or horseshoe shaped with grooved or roughened surfaces to improve mortar bond. Doghouse structures shall be permitted with approval from the WPWD.

Manhole bases shall be cast-in-place concrete, reinforced as shown on the Standard Detail Sheet. Manhole bases shall be cast on a minimum of 6 inches of compacted crushed stone.

Manhole channels or inverts (flow lines) shall be preformed and poured with Class "A" concrete to the spring line of the connecting pipe. The finished invert shall be a semi-circular shaped, trowel and broom finished, smooth channel directing the flow to the downstream sewer.

Manhole frames and lids shall be of good quality cast iron, conforming to ASTM Designation A48 and as shown on Westfield Standard Drawing 03800-007. Unless specifically designated otherwise, manhole castings shall be the non-locking type. The joint between the casting frame and cone section shall be fully mortared or gasketed and coated with butyl rubber or a coal tar epoxy coating upon reaching its final set to become a watertight joint. The casting frame shall be bolted through all risers and into the cone section.

Manhole steps shall be made from a steel reinforcing rod encapsulated in a copolymer polypropylene resin. Steps shall be placed as shown on the drawings.

TABLE 03501-1

Typical Values of Manning's "n"		
Material	*Manning's "n"*	*Maximum Velocities (feet/second)*
Closed Conduits		
Concrete	0.013	10
Vitrified Clay	0.013	10
HDPE	0.012	10
PVC	0.011	10
Circular CMP, Annular Corrugations, 2 2/3 x ½ inch		
Unpaved	0.024	7
25% Paved	0.021	7
50% Paved	0.018	7
100% Paved	0.013	7
Concrete Culverts	0.013	10
HDPE or PVC	0.012	10
Open Channels		
Concrete, Trowel Finish	0.013	10
Concrete, Broom Finish	0.015	10
Gunite	0.018	10
Riprap Placed	0.030	10
Riprap Dumped	0.035	10
Gabion	0.028	10
New Earth **(1)**	0.025	4
Existing Earth **(2)**	0.030	4
Dense Growth of Weeds	0.040	4
Dense Weeds and Brush	0.040	4
Swale with Grass	0.035	4

Source of manning "n" values: HERPICC Stormwater Drainage Manual, July 1995.

(1) New earth (uniform, sodded, clay soil)

(2) Existing earth (fairly uniform, with some weeds).

TABLE 03501-2

Maximum Distance Between Manholes	
Size of Pipe (Inches)	**Maximum Distance (Feet)**
All sizes	400